

SCIENCE.

FRIDAY, JUNE 5, 1885.

COMMENT AND CRITICISM.

THE APRIL ISSUE of the *Zoophilist* is very much a Baltimore number, from the space given to Professor Martin, and to the 'martyrdom' of Prof. J. Rendel Harris. Professor Martin's reply to some strictures made upon his work in an earlier issue of the same journal is treated as 'an angry, exaggerated, and absurd pamphlet' by various writers. We have already made, as we believe, suitable mention of the pamphlet in question, but return to the controversy again because the *Zoophilist* offers so clear an illustration of the unfair and ungenerous methods which find favor with the antivivisectionists. Many of these persons hold views, such that, however much we may disagree with them, they are entitled to respect — and silence. When, however, any person having 'views' is not only unable to perceive that an opponent may be equally earnest and upright, but also uses the press to show him up as a prevaricator, or, more plainly, as a liar, it is time for self-respecting persons to speak out.

The points in the discussion are briefly these: Professor Martin published some experiments which physiologists, and other medical men familiar with experimental work, — i.e., those persons most competent to sit in judgment thereon, — consider a valuable addition to our knowledge of the working of the animal body both in health and disease. In his account of his work — written for these same competent observers, and published where perfect candor and fulness are a matter of professional honor, so to speak — it is expressly stated that these animals were all put under the influence of undoubted anaesthetics or narcotics, except in two instances, where curare was used in order to be certain that the other drugs had not

injured the organ under investigation. The *Zoophilist* people claimed, that, as he used artificial respiration in every experiment, he must also have employed curare in those other cases where it is not mentioned, and made other statements concerning the investigations, which show that a knowledge of some of the most elementary principles of physiology is sadly wanting in the editorial rooms of that paper. The effort to fall back upon information furnished by 'an eminent physiologist' would inevitably result in making him ridiculous, if the mention of his name could be permitted. Professor Martin's reply clearly set forth the nature of the operations performed, and especially the necessity of the tracheotomy and artificial respiration, since he wished to rapidly kill every organ except the lungs and the heart. The *Zoophilist* returns to the attack; but this is a mere reiteration of its former absurdities, with some added excrescences suggested by fresh and perverse misunderstandings of Professor Martin's explanations.

This may, perhaps, seem a trifling matter, but such it is not. Everywhere else, when divergence of views exists, opponents certainly agree to consider each other honest and frank. Such odium as their experimental work may call forth from the unthinking or ignorant mind, and more especially from the feminine type of it, the physiologists can readily endure, but they do fairly claim the right to be looked upon as men of at least as much candor and uprightness as those who oppose their research and yet expect to be classed among the educated and thoughtful. It is the duty of all workers in the different fields of science to stand together in such things, and to insist upon fair and just treatment from these ignorant critics who have the ear of that portion of the public with whom feeling and sentiment are on an equality with knowledge, and abusive misrepresentation passes for argument.

MR. R. A. PROCTOR attempts to explain how earthquakes are caused, in the June number of *Harper's magazine*, and attributes their energy to the action of interior heat on percolating water, and their opportunity to the time of changing pressures caused by atmospheric or tidal loading and unloading of the sensitive crust of the earth. Formidable numbers represent the tons of air or water brought on or taken off certain parts of the earth's surface in the passage of cyclones and anticyclones, and in the rise and fall of tides: but it may be strongly questioned whether these changes of pressure are very effective in determining the time of earthquake snaps; for the changes are gradual and short-lived, the pressures are relatively light, and the surfaces on which they have effect are so broad that the extremely small deformation needed for adjustment of equilibrium might be produced without any cracking or snapping. The omission of clear reference to orogenic earthquakes in such an article is very unfortunate, for Mr. Proctor will have many readers who take him for an authority on such matters; and, in the present attitude of seismology, the orogenic theory is certainly strongly supported by those who give the study the closest attention. It is rather remarkable to find no reference to gravitational distortions of the earth's crust, except in explaining the heat of the interior, after Mallet's method, and no mention of earthquakes following the making of cracks that are freely assumed as the passages by which water enters the subterranean regions, there to be exploded into steam.

LETTERS TO THE EDITOR.

* * * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Real and imaginary Americanisms.

IN the *verbatim* report of Sir William Thomson's famous Baltimore lectures occurs the expression, "and that is why I cannot get the electromagnetic theory." To this, Mr. George Forbes, in his commentary in *Nature* for April 30, appends a footnote: "These reports are generally quite *verbatim*; but I am sure Sir William Thomson is not responsible for this characteristic Americanism." Is it not, rather, a Scotticism? It is no Americanism at all. Although

an American of long standing and considerable observation in such matters, I never heard 'get' by itself used in the sense of 'comprehend' or 'understand.' To 'get hold of,' is a not uncommon colloquial form. But in the same paragraph Mr. Forbes passes unnoticed a real and most prevalent Americanism: 'I do not think I *would* like to suggest,' etc. And again, at the close of the lectures: "I *would* be most happy to look forward to another conference." This substitution of 'would' for 'should' we should charge to the reporter, and feel sure that he was born west of New England and New York, where the just distinction between 'will' and 'shall,' 'would' and 'should,' is innate, while it is lost farther west and south. But the confusion is reaching England, as some recent books and newspapers show. I do not believe that Sir William Thomson has caught the prevalent epidemic, much as he has been in the affected districts. A. G.

The cholera bacillus.

The exact rôle of the 'comma bacillus' in the etiology of cholera Asiatica remains unsettled. Arguments for and against the conclusions of Koch are perhaps equally strong on both sides, as evidenced by the discussions in the conferences on cholera held in Berlin, Munich, and London. Inoculation which completes the chain of evidence required to make good Koch's case, has in his hands, and in those of Nicati, Rietsch, Ermengen, Babes, and Watson Cheyne, produced positive results. Dr. Crookshank of King's college hospital, London, who has been working in the bacteriological laboratory here, and to whom I am indebted for the accompanying drawings, tells me that in Babes's cases three guinea-pigs, out of six

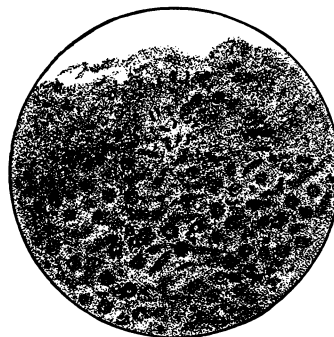


FIG. 1.—SECTION OF INTESTINE IN CHOLERA SHOWING KOCH'S BACILLI IN THE SUPERFICIAL LAYERS.

inoculated in the duodenum, presented the lesions of cholera; and pure cultivations of the bacillus of Koch were obtained from the intestinal contents. Koch has just introduced a new method of operation without the production of any external lesion, and he reports the cases as completely confirming the view of the pathogenic nature of the bacillus. Klein and Gibbs have denied the existence of the cholera bacillus in the intestinal tissue. On the other hand, since Koch's original proof, they have been demonstrated by Babes, and confirmed by Crookshank, by staining the sections after the method introduced by Babes (*vide figure*). This consists in cutting very thin sections in close proximity to a Peyer's patch, placing it in an aqueous solution of good fuchsin for twenty-four hours, washing in a sublimate solution (1-1000),

passing rapidly through alcohol and oil of cloves, well drying with pressure of blotting-paper folded four times, and mounting in Canada balsam. In its

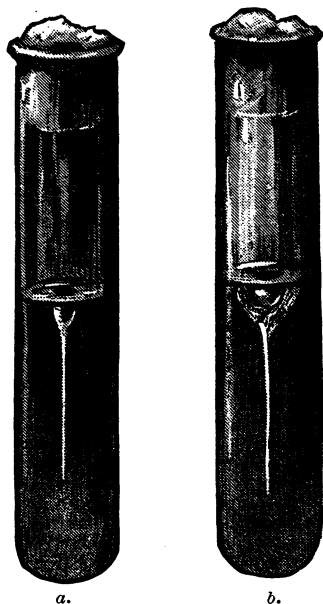


FIG. 2. — CULTURE OF KOCH'S COMMA BACILLUS OF CHOLERA IN NUTRIENT GELATINE.

a, second day; b, fourth day.

biological characteristics, Koch's bacillus differs from that of Finkler and Prior, as will be seen from the following table :—

Koch's bacillus.

Plate-culture. — Colonies faintly golden red; irregular, indented margins.

Tube-culture. — Fig. 2, puncture in nutrient gelatine. Liquefaction commences slowly at upper part of needle-tract; forms a funnel-shaped excavation enclosing a bubble of air; lower part of needle-tract resembles a white thread, and remains so for several days.

Surface-culture. — (Agar-agar). Forms semi-transparent, white plaque; liquid at bottom of oblique surface; becomes milky.

Potato-culture. — Only grows at temperature of the blood (37° C.), forming a transparent, slightly brownish layer.

Finkler's bacillus.

Plate-culture. — Colonies liquefy gelatine much more rapidly; faint, brownish-yellow tinge; larger and rounder margin, well defined.

Tube-culture. — Fig. 3, puncture in nutrient gelatine. Liquefaction more rapid; extends along whole length of needle-tract, and forms a conical, misty culture, gradually resembling the finger of a glove turned inside out.

Surface-culture. — (Agar-agar). The same forms much more quickly; and in addition, after a certain time, a characteristic coffee-colored stratum appears at the bottom of the liquid.

Potato-culture. — Grows at ordinary temperature; culture brown, with whitish margin. Surface of potato appears corroded.

Babes and Crookshank have examined over one hundred pure cultures of Koch's bacilli of various ages and on various media. The round bodies frequently found, either alone, or accompanying filamentous and irregular spirilliform developments of the comma bacilli, were found in all cases to be perfectly sterile. At the recent meeting at Munich,

von Pettenkofer and Emmerich bitterly opposed Koch's conclusions, and asserted that his bacillus had never been found in the mucous membrane of the intestine. The drawing here given, taken from a section of intestine of a patient who died of Asiatic cholera, and prepared by Babes and Crookshank, — a preparation which I have seen many times, — is rather damaging to the Munich school.

I have several cultivations of the Finkler. Prior, and Koch bacilli under observation, and the biological and morphological characteristics of each are distinct and sharply defined.

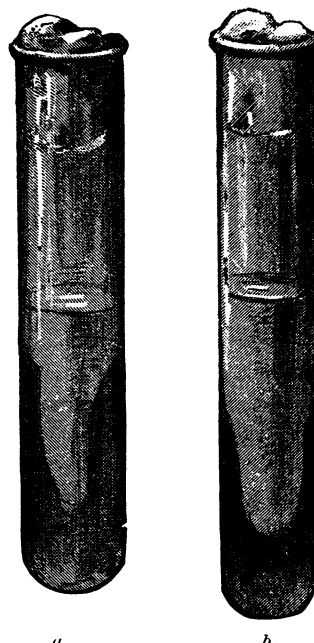


FIG. 3. — CULTURE OF FINKLER AND PRIOR'S COMMA BACILLUS OF CHOLERA NOSTRAS IN NUTRIENT GELATINE.

a, second day; b, fourth day.

Raptchiewski (Wratch., 1885, No. 7) reports an interesting case from St. Petersburg. A microscopic examination of the dejections showed, 1°, long and narrow bacteria, as found by Bienstock (*Zeitschr. klin. med.*, vol. viii.) in normal fecal matter, such as produce putrefaction in albuminous matter; 2°, chains of oval micrococci, similar to the microbes found by the French commission (*Archives de physiologie*, 1884, No. 4, pl. 11, fig. 6); 3°, a bacillus exactly similar to that described by Koch; 4°, another in greater quantity, found by Finkler and Prior in cholera nostras. HORATIO R. BIGELOW, M.D.

Berlin, Germany, May 5.

The reddish-brown ring around the sun.

The ring of reddish-brown color surrounding the sun, and enclosing a disk of glowing whitish light, to which Prof. G. H. Stone called attention in *Science* for May 22, p. 415, has been most carefully studied by Kiessling of Hamburg, who has shown clearly that it is due to diffraction on minute particles suspended in the air. Careful observers agree that it was not seen before November, 1883; but since then

it has attracted much attention. It is manifestly produced in the upper regions of the atmosphere; for it is best seen from elevated mountains, where it is continually visible in clear weather. It is often hidden at low stations by the plentiful reflected skylight that comes from the coarser dust of the lower atmosphere, even though the sky seem tolerably clear. It has been astonishingly distinct here in Cambridge through the past winter, on the clear anti-cyclonic days, with north-west winds, following the withdrawal of the cyclonic cloud-disk; and it attains its greatest visibility between clouds, because much of the lower dusty air is then in shadow, and does not outshine the delicate colors of the ring. On some recent cloudless but slightly hazy days it has been entirely invisible.

I have not observed the connection between the visibility of the ring and the changes of temperature and formation of clouds noted by Professor Stone, and should be glad to learn more details as to date of observations, and as to closeness of the connection in point of time. A comparison of observations on these questions made at Colorado Springs (where I presume Professor Stone made his records) and on the summit of Pike's Peak would be very instructive in this respect.

The most remarkable point in connection with the ring is its persistence long after the cessation of the brilliant twilights with which it began. How is the volcanic dust or the ice dust that causes it supported so long? It seems incredible that dust could simply float for a year and a half in so thin a medium as the atmosphere at a height of ten or more miles. Electrical repulsion has been suggested as a supporting force, and it may be somewhat effective above the level of storm-circulation; but, besides this, it seems possible that the peculiar properties of water-vapor may give some aid. Wollaston long ago speculated on the limitation of the atmosphere at an altitude where its gases were frozen. The solid particles would there fall till evaporated, when the gases thus formed would rise again till frozen once more by the cold of expansion. Ritter and others have recently reconsidered this process. Whether the theory is applicable or not to oxygen and nitrogen, it certainly is of importance when water-vapor is considered: for, as is well known, the elasticity and condensibility of this constituent of the atmosphere are mutually antagonistic. The vapor tends to diffuse itself to altitudes where the cold caused by its expansion would require the condensation of a part of it; and, although such perfect diffusion is prevented in the lower atmosphere by the friction that the vapor suffers in passing through the air, it does not seem unreasonable to believe it may obtain at great altitudes where a normal distribution of vapor must be more nearly attained, and especially so at times when an extra supply of both vapor and dust is shot high out of volcanic craters. We may therefore believe that at some high level the atmosphere is 'saturated' with vapor: above this there will be continual condensation, supplying a delicate shower of the minutest ice particles; and, if these really need a solid nucleus to freeze upon, the nuclei may be sustained by the continuous upward diffusion of the vapor that rises to take the place of that which has been condensed, only to be condensed itself in its turn. Kiessling's discussion of the diffractive action of particles suspended at considerable altitudes fully accounts for the twilights and the solar ring; and the close agreement in date of occurrence of several great volcanic explosions, and subsequent brilliant twilight displays, naturally leads to the acceptance of the volcano as

the source of the diffracting matter. Perhaps the Wollastonian idea may aid in explaining the remaining difficulty; namely, the long-continued suspension of some of the diffracting matter in the upper atmosphere.

W. M. DAVIS.

Cambridge, May 24.

Life.

In the brief abstract in *Science* (May 8, p. 386) of my address on 'Life,' at the celebration of the semi-centennial anniversary of the Lyceum of natural history of Williams college, I am credited with the following statement: "Kick a stone and a dog: the difference in the result is caused by education."

The words are printed in quotation-marks, as if they were my own; and, as a friend tells me that they seem to him to imply a belief that life has been produced by the education of dead matter, and that a stone might be educated into a dog, I hope you will give me space to say that the words are not mine.

Beyond the quotation, with approval, of Huxley's statement, — that "for us, at least, the distinction between living bodies, and those which do not live, is an ultimate fact," — the address contained no opinions regarding the origin or cause of life. It was devoted to the presentation of a definition; and I tried to show, first, that education makes us acquainted with the order of nature, and thus enables us to use one event as the sign of another which is to follow, and to regulate our actions according to the laws of nature; and secondly, that, since all living things respond to the order of nature in the same way, they also are educated; and that education, or the ability to make such responses, is life.

The writer of the abstract in *Science* had no opportunity to consult my manuscript, but I believe that the sentence which I have quoted is from his notes on a passage which reads as follows: "The actions of the dog are significant. They stand in relation to the external world, and their meaning could never be learned from the study of the dog's body, but must be sought in his environment, and that of his ancestors. The real difference between living and dead matter lies in this *significance* of the actions of living things. This is what we really mean when we say that the dog is alive, while the stone is not."

W. K. BROOKS.

EBENEZER EMMONS.

PROFESSOR EBENEZER EMMONS was born at Middlefield, Mass., May 16, 1800,¹ and died at his plantation, Brunswick county, N.C., on the 1st of October, 1863.

He was prepared for college at Plainfield, Mass., under the Rev. Mr. Halleck, entered Williams college at the age of sixteen, and was graduated in the class of 1820.

As a surgeon, Dr. Emmons ranked high in his profession, and for fifteen years was the most eminent practitioner in Berkshire county. He was appointed professor of chemistry at

¹ His birth has been variously stated as in 1798 and 1799; but he always stated to his children that he was born in 1800.

the Albany medical college in 1838, and was afterward transferred to the professorship of obstetrics, his connection with the college continuing until 1852.

Dr. Emmons's chief claim to remembrance lies in his work as a geologist. A favorite pupil of Professor Amos Eaton, he soon became interested in the mineralogy and geology of the western part of Massachusetts, and the adjacent region of the state of New York. Appointed professor of natural history at Williams college in 1833, he held that position till 1859, when he became professor of mineralogy and geology, an office which he held until his death in 1863.

His appointment as geologist of the second district of the geological survey of New York in July, 1836, gave the opportunity for the exercise of his power of acute observation in the field, which made his great reputation as a geologist. In 1837 Dr. Emmons first named, described, and classified the celebrated 'Potsdam sandstone.' In 1842 he pointed out a great system of stratified rocks under the Potsdam, which he called the 'Taconic system.' Two years later Dr. Emmons first described the primordial fauna, preceding the celebrated discoveries of Barrande, who recognized Emmons's right of priority in the

following very courteous manner: "In comparing these dates, it is clear that Dr. Emmons was the first to announce the existence of a fauna anterior to that which had been established in the 'Silurian system' as characterizing the 'lower Silurian' division, and which I have named the second fauna. It is, then,

just to recognize this priority, and I think it all the more fitting to state it at this time, that it has not hitherto been claimed." At a later date Emmons published further details, and described several other primordial fossils in his 'American geology' and 'Manual of geology' in 1855 and 1859.

The following familiar names, divisions, and classifications, of the paleozoic rocks of New York, are also due to Emmons: Chazy limestone, black



E. Emmons

marble of Isle la Motte, Lorrain shales, Champlain group, Ontario group, Helderberg series, and Erie group.

In 1851 Dr. Emmons was appointed state geologist of North Carolina. His discoveries in the coal-measures of Deep and Dan rivers, of a splendid triassic flora, with old vertebrates, such as fishes, saurians, and finally of the oldest mammal (*Dromatherium sylvestre*) yet found, not only in America, but in the whole world, are justly counted among the most important

contributions to the progress of American geology. Indeed, his description of the new red sandstone flora of North Carolina is so valuable, that the U. S. geological survey has recently reproduced the descriptions and all the plates given by Emmons in the sixth part of his 'American geology.'

Although educated in accordance with the Puritan discipline of the old New-England pattern, Professor Emmons was of a cheerful and most amiable disposition, and was respected and beloved by all who came in contact with him. I cannot better finish this too short notice of one of the greatest pioneers of American geology, than by quoting the opinion of one who was acquainted with him during his whole life, the respected and beloved Rev. Mark Hopkins, long president of Williams college, who says, "Emmons was a man of remarkable powers and great accuracy of observation. He seemed to have an intuitive perception of the differences in natural objects. He possessed an intense enthusiasm in his work, but in his manner was remarkably quiet. I have never seen the two things combined to the same extent. His perseverance knew no limit. It ought to be added, that, in connection with his science, he was deeply religious. Williams college is greatly indebted to him for its collections in natural history."

JULES MARCOU.

THE ROYAL SOCIETY OF CANADA.

THE fourth annual meeting of the Royal society of Canada took place last week in Ottawa. The proceedings extended over four days, beginning on Tuesday the 26th; and the attendance of members and delegates was, on the whole, very satisfactory, though not quite equal in number to that at the last meeting. Of fellows, about forty were registered, while thirteen affiliated societies were represented by delegates.

Tuesday was entirely devoted to the general meeting of the society, the morning being occupied by formal business and the reception of reports from delegates and committees; the afternoon, by the addresses of the president, Dr. T. Sterry Hunt, Vice-Presidents Dr. D.

Wilson and Hon. P. J. Chauveau, and his excellency the marquis of Lansdowne as honorary president. Dr. Hunt, in the course of his address, took occasion to urge strongly the utility of the establishment of accurate tidal observations on the coasts of the Dominion, while the vice-president, in reviewing the work of the society, pointed out the special necessity of immediate effort in connection with ethnological research.

The society is divided into four sections, — two dealing with French and English literature, history, and allied subjects, respectively; one with mathematical, physical, and chemical sciences; and one with geological and biological subjects. Over thirty papers, in all, were presented; the meetings of sections going on simultaneously, and occupying the greater part of the time on Wednesday and Thursday. The papers of a purely literary or historical character scarcely fall within the province of this journal. The following notes embrace merely the salient points of some of the more important or novel scientific communications: —

In a paper on the mesozoic floras of a portion of the Rocky Mountain region north of the 49th parallel, Sir William Dawson referred specially to a remarkable Jurassic-cretaceous flora recently discovered, which occupies a stage much lower than the Dakota beds, and gives evidence of a great basin of lower cretaceous rocks in that part of the north-west. The paper was illustrated by a suite of specimens. A second paper by the same author related to certain new points in the geology of Prince Edward Island, and the correlation of the rocks of the island with the Permo-carboniferous, Permian, and triassic, as proposed by Mr. Bain. Mr. G. F. Matthew contributed a third part of his investigation of the Cambrian fauna of the vicinity of St. John, N.B., indicating the division of the Cambrian into several subordinate series, the relations of which, with their European and other equivalents, were discussed. In the Rev. Dr. Honeyman's essay on the geology of M'Nab's Island, Halifax, a point which gave rise to some discussion in the section was the described occurrence of glacially transported fragments of trap rocks like those of the Bay of Fundy. These must have been carried across the entire width of the peninsula of Nova Scotia. Prof. E. J. Chapman gave the results of a close examination of the Wallbridge hematite deposit in Ontario, which he considered as typical of a large class of ore-deposits in that region, and proved to be an irregular mass or 'stock-work' penetrat-

ing the Laurentian strata. Mr. Thomas Macfarlane brought two communications before the society, but read them in abstract only. That on the much-disputed region in the south-eastern part of Quebec pointed out certain critical localities in regard to which additional investigation was desirable. Papers by Prof. Loring W. Bailey and Mr. William Saunders on the economic minerals of New Brunswick, and butterflies of Canada, respectively, being catalogues, were merely explained in general terms. Dr. G. M. Dawson described the Cambrian rocks met with by him in the Rocky Mountains north of the international line, and compared these with those of Nevada and the Colorado Cañon. Professor Ramsey Wright's note on the genus *Hypophthalmus*, was, in the absence of the author, read by title only.

In the physical and chemical section Dr. T. Sterry Hunt gave an exposition of his proposed new classification of silicates, dividing these minerals into three great groups. A second paper by the same author was on the geognosy of crystalline rocks. These are first considered, in relation to condition, as stratified or unstratified, and an endeavor made to define the limits of stratiform structure due to bedding and the flow of molten matter. A further development is then given of the crenitic theory. The author claims that the whole subject belongs essentially to chemistry and mineralogy, and that the speculations of geologists have rather obscured than elucidated, the problems presented by the crystalline series. In continuation of a previous investigation, a paper was read by Prof. E. Haanel, describing certain blowpipe reactions on plaster-of-Paris tablets. These included a mode of detection of osmium with hydriodic acid, and of chromium, antimony, and molybdenum with terchloride of tin. Dr. H. A. Bayne outlined the results of a series of critical experiments on the best modes of determining analytically the amount of silk present in mixed fabrics. He recommended the employment of basic zinc chloride as a solvent for silk in the presence of wool, and of Lowe's alkaline glycerine solution of oxide of copper when silk is combined with cotton and linen fibres. Dr. A. Johnson read an elaborate paper on the best and most economical methods of establishing tidal observatories and investigating tidal currents, dealing particularly with the Gulf of St. Lawrence and eastern coast of Canada. Mr. C. Carpmal brought before the section a paper on the determination, in terms of a definite integral, of the value of the expression

$$\frac{1}{m+n} \left\{ \left(x + \frac{n}{2} \right)^{m+n} - n \left(x + \frac{n}{2} - 1 \right)^{m+n} + \dots \right. \\ \left. + (-1)^r \frac{[n]}{n-r} \left(x + \frac{n}{2} - r \right)^{m+n} + \dots \right. \\ \left. + (-1)^n \left(x - \frac{n}{2} \right)^{m+n} \right\},$$

the series to be continued only as long as the quantity raised to power $m+n$ is positive, n being a positive integer, and m a positive integer, zero, or a negative integer numerically less than n ; and on the deduction therefrom of approximate values in certain cases. After pointing out that Cauchy's investigation fails when m is zero or a positive integer, although Cauchy had assumed without comment that it would hold, the author proceeds to investigate the values of certain 'extraordinary integrals.' The values obtained differ in most cases from those of Cauchy; but the final approximate values agree with them, if we correct certain numerical errors in his results.

In this section the following papers were also read: "On the introduction and rational interpretation of negative and imaginary quantities in the calculus," by Dr. D. Duval; "Note on the quantitative blowpipe assay of cinabar," by Professor Haanel; "On the theory of M. Steckel," by Mr. C. Baillargé; "On some iron ores of Ontario," by Professor Chapman; "A commentary on section ix. of Newton's 'Principia,'" by Professor Cherriman; "The density of weak aqueous solutions of salts," by Professor McGregor; "On longitude determinations at Montreal," by Prof. W. A. Rogers and H. McLeod; "On Clausius' theory of the virial," by Professor London.

Two important ethnological papers were read by Dr. D. Wilson in the section of English literature. The first, "On the manifestation of the aesthetic faculty in primitive races," discussed the evidence of this faculty, and the practice of imitative art among uncivilized peoples. The neolithic period in Europe showed an almost entire absence of such art; but, in the vastly more remote age of the cave-men of France, remarkable indications of it occur. The author compared these with evidences of the art of American aborigines, and stated his reasons for tracing all alike to efforts at sign-language, and ideographic expressions of facts and thought. Dr. Wilson's second communication pointed out, that, in the drawings of the cave-men of France, right-hand profiles are to those of the left-hand as about two to one. The proportion of left-hand drawings is greatly

in excess of what would now be found; but there is still a distinct preponderance of the right-hand, which, however originated, has sufficed to determine the universal dexterity of the whole historic period.

In the French literary section, Abbé Tanguay read a statistical paper on the French population of Canada from 1608 to 1631.

At the closing general meeting on the 29th, the election of several new ordinary members was confirmed, and Prof. T. G. Bonney was elected as a corresponding member. Dr. D. Wilson and Rev. T. E. Hamel were elected as president and vice-president for the next meeting.

PREVENTING COLLISIONS WITH ICEBERGS IN A FOG.

THE recent accident to the steamer *City of Berlin* emphasizes the importance of devising practical methods of ascertaining the proximity of icebergs in a fog. The precautions adopted by Capt. Laud, though they saved the lives of more than fourteen hundred passengers, and prevented serious damage to the vessel, did not prevent contact with the berg. Even the 'look-outs' were unaware of the proximity of the iceberg until it was actually upon them.

Under these circumstances, the method proposed by Mr. Frank Della Torre of Baltimore deserves consideration. His experiments indicate the possibility of obtaining an echo from an iceberg when in dangerous proximity to a ship. Mr. Della Torre believes that even an object offering so small a surface as a floating wreck may in this way be detected during a fog in time to prevent collision. However this may be, it is certain that his method is worthy of a careful trial at sea, and that preliminary experiments, recently made in the presence of Professor Rowland of Johns Hopkins university and the present writer, have demonstrated the feasibility of producing well-marked echoes from sailing-vessels and steamboats at considerable distances away.

These experiments were made on the River Patapsco, near the head of Chesapeake Bay, at a point about seven miles from the city of

Baltimore. The party proceeded down the river in a steam-launch to the selected place, where the distance from shore to shore appeared to be about three miles.

The launch was kept so far from land as to prevent the possibility of mistaking an echo from the shore for one produced by a passing vessel.

The apparatus employed consisted of a musket to the muzzle of which a speaking-trumpet had been attached (see the illustration). This gun was aimed at passing vessels, while blank cartridges were fired. After a longer or shorter time, according to the distance of the vessel, an echo was returned.

The ordinary river-steamboats, and schooners with large sails, returned perfectly distinct echoes, even when apparently about a mile distant. At shorter distances the effects were, of course, still more striking.

In order to test the effects under the most disadvantageous circumstances, blank car-



tridges were fired in the direction of an approaching tugboat. The surface presented was, of course, much smaller than if the boat

had presented its broadside to the launch. As the boat approached bow on, it corresponded to a target somewhere about six feet square, presenting a convex surface to the impinging sound-wave. Even in this case a feeble echo was perceived when the boat was at a considerable distance (estimated to be nearly one-quarter of a mile). That any echo should have been perceived at all under such circumstances, was a surprise. The sound was heard only by the closest attention, but in the case of larger vessels the effects were very distinct and striking.

Experiments were made which demonstrated the fact that the speaking-trumpet attached to the gun was of material assistance in giving direction to the sound-impulse, and in intensifying the audible effect.

Mr. Della Torre claims that a steam-whistle or siren, combined with a projecting apparatus like a speaking-trumpet, will prove as efficient as the gun.

During the experiments on the Patapsco River, a curious rumbling effect, like the rolling of thunder, was often observed, which continued for some seconds. A similar sound was also noticed, as an echo from a well-wooded shore; but the effect alluded to above could not have been due in any way to the land, as the sound commenced immediately upon the firing of the gun, whereas the shore was distant at least a mile or a mile and a half.

The sound was probably due to the presence of ripples on the surface of the water, as the effect was much less marked when the surface was smooth. Such a sound might prove a disturbing element of importance in a rough sea, but would hardly be sufficient to prevent the detection of an echo from a large iceberg. Had shots been fired periodically from the bow of the City of Berlin, it can hardly be doubted that the presence of an obstacle ahead would have been discovered in time to prevent the collision that actually occurred.

ALEXANDER GRAHAM BELL.

SOME PECULIARITIES IN THE AGE STATISTICS OF THE UNITED STATES.

SHORTLY after the issue of the present census reports, attention was called to the peculiar fact that very many more persons were recorded as being just 20 or just 50 years old than were as being 19 or 49. It is easy to see that there ought to be more persons living at any one year of life than at the next, — more at 7 than at 8 years of age, more at 19

or 49 than at 20 or 50. Of all the infants less than a month old at the present moment, quite a large number will die before completing their first year; many of those then surviving will die before the end of their second year; and so on, there being fewer left in each year than in the preceding year.

But all this is true only when certain conditions are satisfied. The growth of the population, it is assumed, is by natural increase alone, or nearly so. The number of foreign-born inhabitants, for instance, between the ages 10 and 15, will be smaller (that of native Americans, of course, very much larger) than the number between the ages 20 and 25, because so very many of the immigrants are, on arrival, between 20 and 25 years old. So, too, a war, or an epidemic which is particularly fatal to persons between certain ages, might be the cause of an exception to the general rule, at least until the generation so affected had died out.

But the effect of any such circumstances on the census figures which are here dealt with, may, without hesitation, be regarded as insignificant. The preponderance of the number of persons at the ages containing round numbers, over the number at the age immediately preceding (this being rather an 'odd' number), must be ascribed to an entirely different kind of influence.

Before going farther, it is necessary to appreciate how enormous the attraction towards round numbers really is. Very naturally this attraction is greatest towards the ages containing multiples of 10, for then the numbers are 'roundest.' Subtract the number of persons recorded as 9 years old from the number recorded as 10, and express this excess in percentage of the number at 9 years. Do this for the excess of the number at 20 over the number at 19, of 30 over that at 29; and so on, the last being the excess of the number at 90 over the number at 89 years of age. The average of the 9 percentages thus obtained is what I will call the average '10 exaggeration,' any one of the percentages of which it is composed being spoken of as the '10 exaggeration' at 20 or 30 or 60 years, as the case may be. This average for the total population of the United States is $71\frac{1}{4}\%$; and the several percentages of which it is the average vary from 9.5% to 126% . This means, that instead of finding fewer persons recorded at any such 'round' age as 20, 30, etc., than at the age immediately preceding (19, 29), you would find, on the whole, nearly $1\frac{3}{4}$ times as many. You might find only $1\frac{1}{10}$ (an excess of 9.5%)

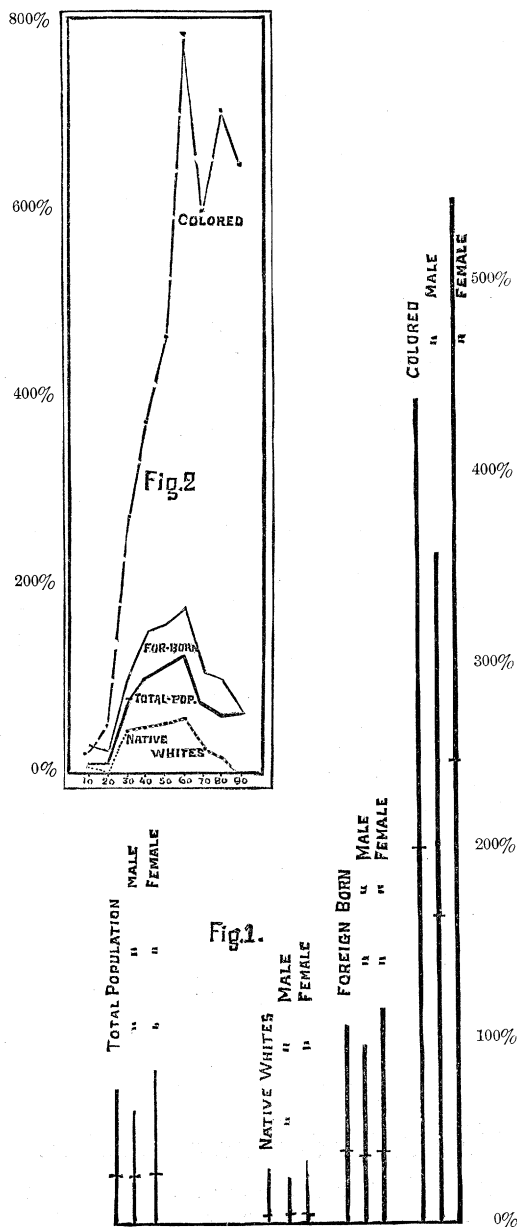
as many if you happened to select 10, or even $2\frac{1}{4}$ times as many (an excess of 126 %) if you selected 60, as the age.

The comparison of this average '10 exaggeration' for the total population, with that for the native whites, the foreign-born, and the colored inhabitants,—making, in each case, the distinction between male and female,—will serve as a good starting-point. Fig. 1 expresses the result graphically. The first of each group of three lines shows the '10 exaggeration' of the total number of the class which it represents; the second line that of the male, and the third that of the female, portion of it. The first set of three lines represents these averages for the total population; the second, for the native whites; the third, for the foreign-born; the fourth, for the colored population.

The enormous exaggeration of the colored¹ people is the first striking, appalling fact. Their average '10 exaggeration' is 432 %: in other words, there are $5\frac{1}{3}$ times as many colored persons recorded at any age containing a multiple of 10 as at the preceding age. The native whites, as one would expect, are the most reliable class, their average excess being 28 %. The average of the foreign-born (103 %), while not in all strictness comparable with the others, may yet be considered so for our purposes. It is evident that the negro is the being upon whom all the various causes tending to produce this peculiar falsity of returns are the most active. The foreign-born are also very susceptible to these tendencies; and doubtless misunderstandings between the foreigner and the census official, owing to a meagre acquaintance with the language, enter as an additional disturbing influence. Moreover, in both these classes the general illiteracy is decidedly above the average.²

The next consideration is that of sex. The gentler sex in each case exaggerates more than the male sex, and, in the case of the colored people, considerably more. For the total population, the male average is 61 %, the female 81 %; for the native whites, male 22.5 %, female 33.5 %; for the foreign-born, male 92.6 %, female 113.8 %; for the colored, male 352 %, female 536.5 %. The average excess of the native white males (22.5 %), and that of the colored females (536.5 %), serve as a significant contrast. Next to the exaggeration

at the ages containing multiples of 10, naturally comes that at the ages containing multiples of 5. This '5 exaggeration' follows the



¹ It should be mentioned that under this head are included the Chinese, Japanese, and civilized Indians; but the exclusion of these would not appreciably alter the results.

² I have traced out in detail the close relation between this '10 exaggeration' and illiteracy, which, however, would be too long to give here. A set of lines representing the illiteracy for the several races and sexes would closely resemble fig. 1.

same course with reference to race and sex as the '10 exaggeration,' and is represented in fig. 1. by the part of each line cut off between the cross-mark and the foot of the line. For the total population it is 26 %, as compared

with 71 % for the '10 exaggeration;' for the native whites it is 3 %, as compared with 28 %; for the foreign-born 36 %, as compared with 103 %; for the colored 200 %, as compared with 432 %.

If we subdivide the native male whites, the most reliable class, into the native male whites of each state and territory, we find great differences between the averages of the several states. The inhabitants of New Mexico, though native male whites, are in the habit of mendacity, at least Mexicans, and their '10 exaggeration' is 292 %. So, too, the native male whites of the southern states, where too close intimacy with the 'round-number loving' negro seems to be dangerous to statistical accuracy, have a high average; while all the New-England states are in the best third of the list, and all but Rhode Island in the best dozen. Other good states are Iowa, Ohio, Pennsylvania, Indiana, Minnesota, Wisconsin, and Michigan.

Having ascertained to what extent each race and sex exaggerates with reference to 'round-number' ages, it remains to trace the extent of this exaggeration at each of the 'round' ages. In this the graphic method will be an aid. The heavy line in fig. 2 represents the variations in the size of the '10 exaggeration' at the ages 10, 20, etc., up to 90 for the total population: the dotted line does the same for the native whites, the light line for the foreign-born, and the broken line for the colored. The distance from the point where the curve begins to the base-line measures the '10 exaggeration' for the number at 10 years; the distance from the point of junction with the second ordinate to the base-line measures the exaggeration for the age of 20; and so on, as indicated at the foot of the diagram. With the exception of that for the colored people, the curves are very similar. In each case, the ordinates are about as high at the point 20 as at the point 10; i.e., persons in the neighborhood of 10 years of age are about as apt to call themselves 10, as those in the neighborhood of 20 to call themselves 20, years old. After this point, however, the excess gradually increases for each decade, until the maximum is reached at 60. From 60 on, there is a more or less uniform fall to the last point at 90. But in the colored race the work of exaggeration is developed on a much vaster scale. Each decade has a higher excess than its predecessor, until, in this series of steep ascents, the apex is reached, as before, at the age of 60, when the excess is 930 %; that is, over 10 times as many colored people lay claim to the

age of 60 as to that of 59. After the point 60, the exaggeration falls, but rises again at 80, ending with a slight fall at 90.

With regard to sex, as before, at each age (except at 10)¹ the females exaggerate more than the males: these differences are greatest at 70, 80, and 90 years.

It is natural that the giving of one's age in round numbers should be a more common practice with old than with young people. There is a greater difference between being 19 and being 20 years old than there is between being 59 and being 60. Younger persons, too, are more apt to know their exact age than older ones. The second half of each curve, then, is higher than the first half: this is especially evident in the curve for the colored people. But why this excess should be greatest at 60, is not apparent: 50 would probably have the strongest claim to be considered the 'roundest' age. Or is 59 an 'odder' number than 49? It seems that the condition of mind to which a round number is most apt to present special charms is most likely to occur near the end of the fifth decade of life. The age of 80, however, in the case of the colored people, plays almost as prominent a part as 60. The fact, too, that in the seventh, eighth, and ninth decades of life the greatest differences between the exaggerations of the two sexes occur, is interesting. It seems to indicate that old women, and notably old colored women, are far more forgetful of their ages than old men. For the colored males, the exaggeration at 80 is 520 %; for the females, 920 %.

If we were to trace similar curves for the '5 exaggeration,' we should find, 1°, that they would all be much lower (i.e., the exaggeration is less, as is also shown in fig. 1); 2°, that the curves would hold the same relative positions, — the native white lowest, then the total population, then the foreign-born, and much higher the colored; 3°, that the highest excess occurs at 45, except in the colored curve, where it is at 75; 4°, that the curves are less regular; 5°, that the exaggeration of the females is greater than that of the males, and differs most from it at the higher ages. It is peculiar that the greatest '5 exaggeration' occurs at 45, while the greatest '10 exaggeration' occurs at 60. The exaggeration at 65, however, is not much smaller than that at 45, and in the colored is actually larger, though here both are smaller than the excess at 75. This is what the 'roundness' of the number '75' would lead one to expect.

While in the '10 exaggeration' the second

¹ And here the difference between the sexes is very small.

half of the curve is higher than the first, in the '5 exaggeration' the two halves (except in the case of the colored people) are about equal. The '10 exaggeration' is thus rather a characteristic of old age, while the '5 exaggeration' is used by old and young.

There remains another peculiar irregularity of the census figures which deserves special treatment. It is the excess of the number of persons at 21 over those at 20 years. This excess is not of the same nature as the '10' or '5' exaggeration, and is due, of course, to political reasons; 21 being the voting-age, and 1880 the year of a hot presidential campaign: accordingly this exaggeration ought to occur in males alone. This is really the case. In estimating the size of this excess, we encounter a difficulty. To compare the number at 21 with the number at 20, would probably be comparing one exaggerated number with another; and, knowing that the number at 19 is too small, we cannot make a fair comparison with it. It is sufficient to notice, however, that there are always more males (and fewer females) at 21 than at 19, and, when the '10 exaggeration' at 20 is not large, more than at 20. Taking into consideration the excess at 20, we have to declare the native male whites (the most reliable class in the former exaggerations) as the class that exaggerates most at 21, — a conclusion quite natural, because they are most apt to be benefited by such falsity of returns. With regard to states, the inhabitants of the extreme west (Dakota, Wyoming, etc.) would rank as the worst, the New-England states as the best, under this head.

Whether this exaggeration is increasing or decreasing, is a question which unfortunately can be only very partially answered. Previous to 1880, the returns on age were given mainly in groups of five years. In 1870, however, all persons above 80 years of age were enumerated by single years. This makes possible a comparison between the excess of the number at 90 over that at 89 in 1870 and in 1880. This comparison is entirely in favor of the census of 1880. In this decade the exaggeration at this particular age (90 over 89) has fallen, for the total population, from 104.6% to 65.7%. As to sex, the male excess has fallen, from 87.1% to 36.7%; the female, from 118.7% to 90.3%. The colored people, too, have decreased their excess very greatly, — from 1267% to 647%. Two other peculiarities in the returns of 1870 may be noted: first, the difference between exaggerations of the sexes is less, disappearing entirely in the colored race; second, the excess in the native whites is

exceptionally high, being 155.3%, while in 1880 there is no excess at all, but a deficiency of 4.8%.

The observation of such facts as have been here noticed, it is hoped, will shed light on the characteristics of the natural bias in favor of round numbers, as well as be a means of suggesting modifications in the method of questioning which would obviate these misrepresentations. It is just such irregularities that detract from the value of the census figures with regard to the calculation of the life-period, and expectation of life, in the United States. A more thorough comprehension of the questions treated above will doubtless be attainable from the census reports of 1890.

JOSEPH JASTROW.

CHOLERA INOCULATION.

A LETTER from Dr. J. Ferran of Tortosa (Catalonia) to the French academy (*Comptes rendus*, No. 15, 1885) contains some interesting assertions in regard to cholera and the cholera bacillus. He finds that cultures in *bouillon* at 37° C., carried on long enough to just visibly change the fluid, will, in doses of from two to four cubic centimetres, kill a guinea-pig.

At the point of inoculation appears a hot and painful tumor, which dries up and becomes detached, leaving an ulcer behind, which heals without pus formation or pain. The general symptoms are a rapid rise of temperature, bringing on a lowering of the physiological heat as taken in the rectum.

If a drop of blood be taken from an animal thus inoculated, and during life, and this drop be inoculated in *bouillon*, kept at 37° C., in from twenty-four to forty-eight hours a pure culture of spirilla will be obtained.

Microscopic examination of the serous effusion, coming after a blow upon the inoculated side, shows the following:—

1°. Extraordinary number of globules, so much so as to make one doubt the nature of what is being observed. Many of the red-blood globules have projections, and possess a real movement due to the striking of the microbes against these points. 2°. Spirilla and commas, almost invisible by reason of their rapid movements. 3°. Spherical cells full of granulations, some of them containing a granulation resembling a degenerated blood-cell. 4°. Lenticular elements, varying from five to twenty millimetres in size, and differing from the others described above.

A series of cultures in gelatine preserves its virulence, whilst a series in *bouillon* becomes attenuated after a certain time. If a series of guinea-pigs be inoculated with a quantity of the culture less than sufficient to kill them, they become capable of resisting doses which would before have been fatal, — a result which the writer claims he has obtained.

Effects of the microbe upon man. — The injection

of eight drops of a fresh, virulent culture in the region of the triceps brachialis produces a hot and painful swelling, which hinders the movements of the arm; following this comes a localized fever, which soon disappears; three hours after the injection, this phenomenon commences, continues about twenty-four hours, and then all effects disappear completely. If an injection of five-tenths of a cubic centimetre be made in each arm, the local symptoms are intensified, and general symptoms appear. These general symptoms bear an undoubted resemblance to true cholera; as, general coldness, rigors, lassitude, cramps, vomiting, dull mind, cold and clammy sweats, more frequent evacuations (but never reaching the true diarrhoea of cholera).

All of these symptoms are followed by a general rise of temperature, reaching even 2.5° C. above normal. More frequently there are more or less accentuated chilliness, general lassitude, dulness, desire to vomit, and fever. All of these symptoms cease at the end of from twenty-four to thirty-six hours, without necessity for a recourse to therapeutics. Sometimes they are more severe, and the blood from any part of the body gives the same microscopic appearances as in animals.

If, six or eight days after the injection of five-tenths of a cubic centimetre in each arm, the same dose, and of the same virulence, be injected into the same subject, the general symptoms do not occur, whilst the local phenomena are much less severe.

The writer draws these conclusions from his experiments, and offers to reproduce his results before the academy: 1°. "Choleration is possible in man, as in animals, by hypodermic injection." 2°. "The prophylaxis of choleration is obtained through graduated doses, or attenuated virus."

Dr. Ferran, no doubt to add weight to his paper, gives the names of twenty-four physicians, five medical students, five other males, and five females, upon whom he has experimented.

These experiments are said to have been carried on farther, but no proper report of them has as yet reached us. Our criticism would be that the conclusion as to the efficiency of the inoculation against cholera, granting that the true bacillus of cholera was used, is an exceedingly hasty one, inasmuch as the protected (?) persons had not yet been brought in contact with the disease.

HERAT'S IMPORTANCE.¹

THE reasons for the importance of Herat are of three kinds,—geographical, ethnological, and historical.

With regard to Herat's geographical situation, it will be seen at once that from Siberia to India, with the exception of the oasis in the Zerafshân basin, there is scarcely a point to be found which can bear comparison with Herat in regard to fertility and climatic advantages. Lying on the western and

northern spurs of the Paropamisus Range, which is connected with the lower mountain range of Persia by the ridge of Siah-Bebek, the district of Herat is provided with an extraordinarily full river-system. Water, the most important auxiliary of agriculture in Asia, is therefore to be had in plenty; and the canals leading from the numerous water-courses, can, in consequence of the undulating surface of the district, be turned to account for irrigation in a very effective manner. Under the protection of political quiet, and with moderate industry, Herat could easily be turned into a garden; and that it frequently has indeed been a fruitful garden, whose manifold productions have awakened the envy of the neighboring powers, we have the testimony of history.

In regard to climate, Herat is equally favored. While with two degrees north or south the heat becomes unbearable, Herat enjoys a surpassingly mild climate, under whose influence the products of the north and the south ripen in equal perfection, and an agreeable habitation for mankind has always been provided.

It is no wonder, then, that the western district of Herat, commonly called Baghiz, was, even in antiquity, described by the geographers with enthusiasm. Ibn Haukal, Mukadassi, Edrisi, and others call Baghiz the 'crown of Khorasan:' the author of the geographical work 'Heft-Iklim' calls it a flower-garden of enchantment, with a thousand vales of trees and streams,—a camp-ground rich in grass and water, peculiarly suitable for the resting-place of the largest armies.

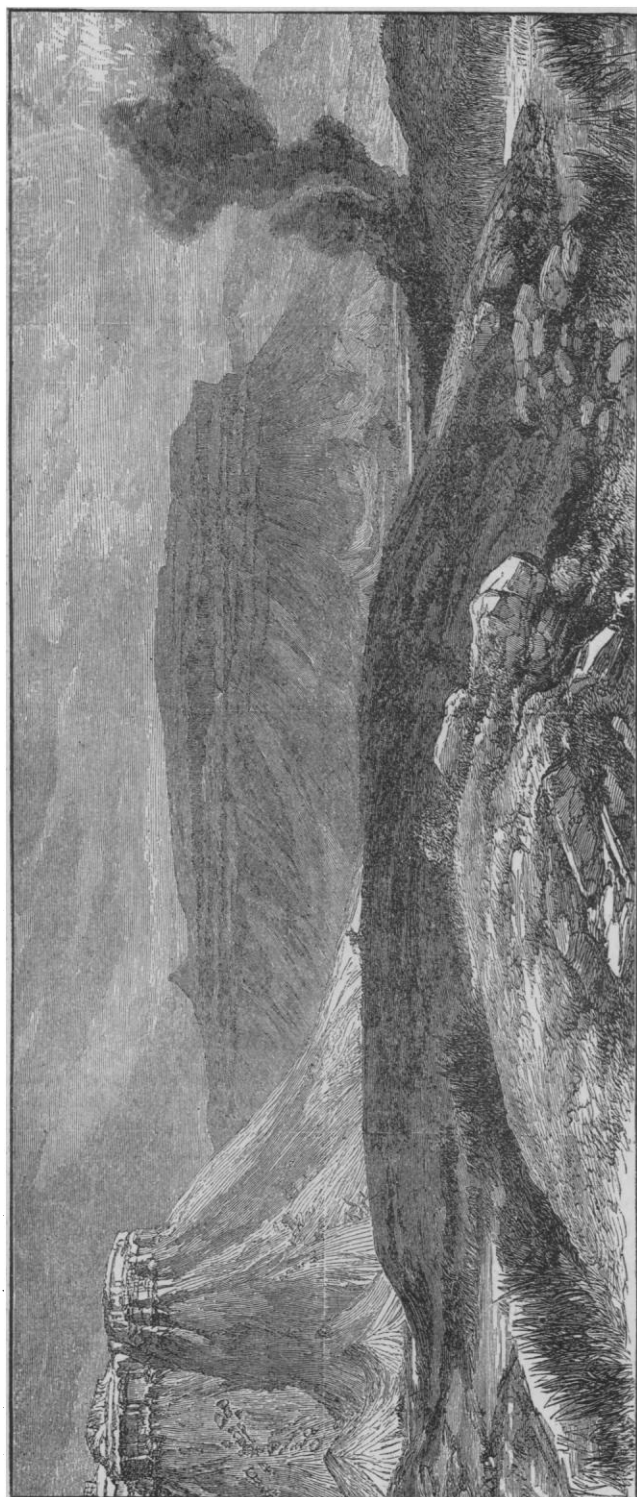
Indeed, this fame extends back even to pre-Islamic times. Herat's wealth was proverbial; as witness the expression, "Khorasan is the mussel of the world, and Herat is its pearl."

As to the boundaries of this Baghiz, which to-day figures as the cause of the quarrel between England and Russia, they have been understood from the earliest times to be, on the west the Hari-Rud, and on the north the edge of the steppe, which, extending from Pul-i-Khisti to Shir-Tepe, marks the line between the cultivated oasis and the bottomless sand-desert.

In passing now to the ethnical features of Herat, it is to be noticed at the outset that it is exactly the miscellaneous character of the population which makes the work of conquest easy, and furnishes such means of civilization as would be sought elsewhere in vain. Among the million and a half inhabitants of Herat and its surroundings, the autochthonous Iranians hold the first place. For the most part, they are dwellers in towns, and have at all times distinguished themselves by their industry, perseverance, and special intellectual talent. It was they who produced so many brilliant periods of the Moslem culture; and the literary productions of the Herat writers, as well as the monuments of Herat artists and architects, are still subjects of admiration.

The population of the outlying districts bears the general name of Tshehar-Eimak,—i.e., four tribes,—and traces its origin back to the times of the Timurides. The former word is of Persian origin;

¹ From an article by H. VAMBÉRY in the *Oesterreichische monatschrift für den orient*.

ZOLFIKAR PASS. (*London illustrated news*.)

the latter, of Mongol-Turkish. Of these four tribes, the Dshemshidis are the most important. They were formerly much more numerous than now. To-day they number about six thousand families, of which four thousand dwell at Kushk, a place near the sources of the river of the same name; a thousand at Bala-Murgáb; and a thousand at Kurukh. Most of them lead a half or wholly nomadic life, and have adopted Turkish manners and customs, although favorable political circumstances might easily turn them into peaceful, industrious citizens.

Next to these come the Firuzkulis, whose territory extends from Bendi-Turkestan on the north, to the sources of the Hari-Rud on the south. They are also of Iranian origin, and fall into two distinct sub-tribes, — the Derzais and the Mahmudis. They comprise, in all, eleven thousand families, and their chief town is Kila Nau ('New Fortress'), which really lies in the territory of the Hazaras. At the present time the tribe of the Derzais dwells in the mountain region, while the Mahmudis occupy the lowland. The Teimenis, fifty thousand families strong, live in the region lying south of the Hari-Rud, and, in spite of their unmistakably Mongolian origin, have become completely settled, and even enjoy the reputation of being excellent cultivators. The fourth member of the Tshehar-Eimaks is the tribe of the Teimuris, who inhabit the western part of the Baghiz district, and are at home at Pul-i-Khatun, Germ-ab, the pass of Zolfikar (a cut of which is here reproduced from the *London illustrated news*), and along the whole eastern boundary of Persia. They number about fifteen thousand families, and form the ethnical element, so to speak, which first brought about the difficulty between the two European rivals.

Taken all in all, the inhabitants of Herat form, indeed, the best possible element for the designs of a foreign conqueror; for they have been accustomed for centuries to foreign rule, and, with slight exceptions, are hostile equally to the Uzbek on the north, the Afghan on the south, and the Persian on the west. Their greatest political ambition, the independence of Herat, has seldom been realized; and if now, when European conquest is extending to this part of central Asia, either the Russians or the English should succeed in becoming estab-

lished here, they would find in the ethnical relations such a basis of power, and accordingly obtain such a firm foothold, that their dislodgement would be no easy task.

We have still to speak of the part which Herat, for the very reason of the advantages referred to above, has played in the past. Herat is to-day, to some extent, the centre of trade between India, Persia, and central Asia, where new goods are exchanged, the packages are overhauled and re-arranged, and the caravans spend some days, or even weeks, in resting for their farther journeys. And so, in antiquity, Herat was the point from which almost all the conquerors of India and western Asia set out. Alexander the Great stopped there in 327 B.C.; the Mongolians under Dshengiz halted there in 1220 A.D., before going on to the Indus; Timur passed through Herat on his march toward India in 1381; Sheibani Khan, the Uzbek prince, was intending, in the beginning of the sixteenth century, to start from Herat to India; and Nadir Shah, in 1731, did not dare to attempt the way toward southern Hindostan until he was in possession of Herat.

History repeats itself everywhere with very similar episodes. What the early Mohammedan and Buddhist adventurers attempted when they crossed the Oxus, and, attracted by the rich treasures of India, went towards the south, is the same thing which the present successors and representatives of the Tartar warriors — viz., the Russians — are aiming at; for they, too, have an eye upon the fields of India, however much czars and ministers disclaim the fact, or Russian scholars talk of the 'noble mission of culture' fulfilled by the attempts of their army in Asia. If Russia had not already spent over four hundred million dollars in carrying out her policy in central Asia, and if this central Asia were not such a useless acquisition, which can never be a source of revenue, but always an expense, we might put some faith in these assertions; but no one is so simple nowadays as to ascribe persecution on the part of individuals or states to purely philanthropic or unselfish motives. Russia wants the 'Gate of India' in order to reach India; and the essential difficulty in her plan consists in the fact that the land on the Ganges and Indus is controlled, not by effeminate Brahmins, or the degenerate successors of Baber, but by the active, highly educated, and powerful Briton, and that any aggressor at present, instead of carrying home the golden gates of the palace of Somnath, as did Mahmud the Ghaznewid, would be much more likely to come off with a broken head.

COPE'S TERTIARY VERTEBRATA.

WHEN this immense work is completed by the issue of the second part, we shall have by far the most extensive and valuable survey yet

attempted of the tertiary vertebrates, which have been discovered in our western territories in such amazing profusion. Dr. Leidy's excellent volumes now cover but a small portion of the ground, which has been so greatly extended since they were written. In Professor Cope's new book, which looks as formidable as an unabridged dictionary, one hardly knows whether the vast collections which he has brought together, or the skill with which they have been worked up, is most to be admired; for this book is no mere wearisome compilation of descriptive details, but a notable contribution to morphology and the theory of evolution.

After a general account of the tertiary formations of the central United States, the introduction proceeds to a much-needed discussion of the correspondences between the geological periods of Europe and North America. This has often been attempted before; but the new material lately obtained sheds much light upon these vexed and difficult questions. In the paleozoic formations, these identifications can in many cases be made easily and certainly; but in the mesozoic, and still more in the tertiary, deposits, they become very problematical. A starting-point, however, seems to be given to us in the Wasatch of America, which seems to be the exact equivalent of the French Suesonian: later than that, the correspondences seem to be but general. Professor Cope still maintains his former view, that the Laramie (the great coal-bearing formation of the region west of the Missouri) is of cretaceous age. In this connection, it is interesting to compare with Professor Cope's arguments those advanced by Professor Lesquereux in his work on the cretaceous and tertiary flora, which has just been issued as volume vii. of this same series of reports. Professor Lesquereux attacks the problem chiefly from the botanical side, but, after reviewing all the evidence attainable, pronounces emphatically in favor of the tertiary age of the Laramie. It seems to us that Lesquereux makes out rather the better case, and that possibly the Laramie may prove to be contemporary with the earliest eocene formation of this country, the Puerco; the former being composed of swampy and estuarine deposits, and the latter of lacustrine. This view is much strengthened by the recent discoveries of Laramie dinosaurs in the Puerco, and of marsupials like those of the Puerco in the Laramie. Further evidence must, however, be awaited, before the hypothesis can be accepted.

It is to be regretted that Professor Cope

The Vertebrata of the tertiary formations of the west. By E. D. COPE. Book 1. (Rep. U. S. geol. surv. terr., vol. iii.) Washington, Government, 1884. 1,009 p., 135 pl. 4°.

did not add to this section of his introduction a general survey of the animal life in each of the periods which he afterwards treats in detail. Such a summary would have been exceedingly useful.

Before examining the book in detail, it will be of advantage to direct the reader's attention to Dr. Hayden's summary of "the most important contributions to paleontology and evolution," contained in his letter of transmittal of the volume before us. These are: 1°. The discovery of the Puerco fauna. This includes the discovery and description of three new families of a new order (the Taxeopoda), and a new sub-order (the Taligrada); also the discovery of the *Plagiaulax* type (of the Jurassic), and other marsupials, and of a genus of Laramie saurians. 2°. The discovery of complete remains of the Wasatch types, *Phenacodus* and *Coryphodon*. "The light thrown on the phylogeny of the Ungulata by this discovery exceeds that derived from all other sources together." 3°. The new classification of the lower clawed mammals, founded on the analyses of a great number of new genera and species. 4°. The restoration of the four-toed Wasatch horse, *Hyracotherium*. 5°. The restoration of the Bridger genera, *Hyrachyus* and *Triplopus*. 6°. The determination of the systematic relations of the Dinocerata.

Turning, now, to the body of the work, the first chapter to demand notice is that on the fishes. The shales of Green River, Bear River, and Florissant, Col., have long been famous for their abundance of fish-remains. Our knowledge of these forms is almost entirely due to Professor Cope, but hitherto he has figured none of them. In the present volume there is a very welcome series of plates that illustrates all the types. It is a pity that Professor Cope has adopted the classification he uses, which, being founded entirely on the skeleton, and ignoring the structure of the soft parts, is necessarily imperfect and misleading.

Perhaps Professor Cope's most signal service to paleontology is his discovery of the exceedingly curious and interesting Puerco fauna, the earliest known from any tertiary formation. This assemblage of mammals is of extraordinary interest, both to the morphologist and the geologist, and goes a long way towards bridging over the gap between the tertiary and mesozoic ages. The characteristics of this fauna were given above, but we must again insist on the immense value of its discovery.

In the Wasatch, the second epoch of the

eocene, we are presented with a no less interesting series of mammals and reptiles. The only full account extant of American tertiary turtles and crocodiles is here given. Further, our knowledge of the Wasatch mammals is almost altogether owing to Professor Cope, whose explorations of the Big Horn basin in Wyoming yielded such extensive collections. The chapters on the ungulates of this formation are of especial importance. The study of these has confirmed the author's prediction, made in 1873, that the earliest ungulates would prove to be five-toed and plantigrade, and has enabled him to construct a scheme of all the ungulate series, which, however we may differ as to its details, must be admitted to be a masterly presentation, and full of most valuable suggestions. These chapters, and especially the descriptions of the skeletons of *Periptychus* from the Puerco, and the Wasatch genera *Phenacodus* and *Hyracotherium* Owen (*Orohippus* Marsh), of which Professor Cope gives the first complete account, are to be particularly commended to careful study.

A very welcome section of the book is that on the order Amblypoda, which includes the Dinocerata and the Coryphodons. This order, proposed in 1873 by Professor Cope, has recently been adopted under the name of Amblydactyla by Professor Marsh. The latter's work on the Dinocerata is so much fuller and more complete than Professor Cope's chapters on them, that we need not stop to consider the latter, except to mention the curious Bathypsis. But nearly all that is known of the Coryphodons is due to Professor Cope's labors, and the value of his results in this field it is difficult to exaggerate.

Professor Cope has brought order out of the chaos of the small mammals which abound in the eocene, and which, with great diversity, pass into each other by imperceptible gradations. He groups together the early flesh-eaters—which were not true carnivores, but small-brained forms allied to the insectivores—under the name Creodonta, giving in many cases very complete accounts of their structure, and indicating the forms from which descended the various families of the true carnivores. The same service has been done for the primitive lemurs, the most interesting of which is the little Wasatch *Anaptomorphus* homunculus, which has as large a brain as, and in some respects a higher type of dentition than, any existing lemur, and which seems to be a progenitor of the monkeys. Did space permit, the curious *Taeniodonta* would demand notice.

In the Bridger formation, Professor Cope has not achieved such great things as in the earlier periods. Nevertheless, the sections on the reptiles, the rodents, and the tapiroids Hyrachyus and Triplopus, are notable contributions to the subject.

In closing this very brief and inadequate sketch, we must call attention to the beautiful series of miocene carnivores with which part i. ends. Nothing can exceed the perfection of their preservation, and they enable the paleontologist to follow the evolution of the group without difficulty. Professor Cope says with much truth, "No fuller genealogical series exists than that which I have discovered among the extinct cats."

As is unavoidable in the case of a volume nearly five years in course of printing, this book contains much that riper judgment and fuller knowledge have modified. Thus have arisen the occasional contradictions between different parts of the book; and in recent articles in the *American naturalist* the author has expanded and modified many of his conclusions. But, aside from these, some of his results are open to serious question, and with scarcely any of his phylogenetic tables can we fully agree. His tendency seems to be to generalize too hastily from the study of some special structures, as the dentition or the feet, to the exclusion of other important parts. The book has been rather carelessly printed, and shows many typographical errors; and the references to the plates are frequently and annoyingly wrong, compelling the reader to a tedious search. The plates themselves cannot be praised: many of the figures are badly drawn, and in one case, at least, the drawing is ludicrous (woodcut, fig. 25a). With few exceptions, the lithographic work is not up to the usual standard of the Sinclairs, and contrasts unfavorably with the exquisite workmanship of Professor Marsh's volumes.

But, in spite of these drawbacks, Professor Cope has done a grand work, which is an ornament to American paleontology, and must ever remain a landmark in the history of the science, as well as "a monument to the labor and genius of its author."

PHILLIPS'S ORE-DEPOSITS.

CONSIDERING the immense importance of the mining industries, it is remarkable that there have been so few treatises on the manner of

A treatise on ore-deposits. By J. ARTHUR PHILLIPS, F.R.S. London, Macmillan & Co., 1884.

occurrence and origin of the various ore-deposits.

With two or three noteworthy exceptions in Germany, and one or two in France, the literature on this subject is confined to the vast number of special papers. Whitney's 'Metallic wealth of the United States,' a model work which has been of great usefulness, treated, in its descriptive part, only of our own country. Mr. Prime's translation of von Cotta's 'Erz-lagerstaettenlehre' has been for years the only general work on the subject in the English language. Since that was written, our manifold mining industries have assumed an importance that will be best understood when we say that during the year 1880 there were nearly ten thousand mines of all kinds and sizes operating east of the 110th meridian. This does not take into account the mines of the precious and other metals of the west, which must number over three thousand. There is a pressing need of a general work based on a survey of our own rich field.

Pending the appearance of such a work, this book by Mr. Phillips, who has visited many American mines, draws largely, both for facts and theory, from the American experience of its author, and will be found to be very serviceable.

In its general plan and appearance it recalls von Cotta's work. The first hundred pages are devoted to the general classification of deposits. The remaining five hundred or more pages describe in detail the noteworthy and instructive occurrences throughout the world.

The classification adopted is well chosen, and is as simple as is consistent with our knowledge of the subject.

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|--------------------|---|---|
| I. Superficial. | { | a. Deposits formed by the mechanical action of water. |
| | | b. Deposits resulting from chemical action. |
| | | a. Deposits constituting the bulk of metalliferous beds formed by precipitation from aqueous solutions. |
| II. Stratified. | { | b. Beds originally deposited from solution, but subsequently altered by metamorphism. |
| | | c. Ores disseminated through sedimentary beds in which they have been chemically deposited. |
| | | a. True veins. |
| | | b. Segregated veins. |
| | | c. Gash veins. |
| III. Unstratified. | { | d. Impregnations. |
| | | e. Stock-works. |
| | | f. Fahlbands. |
| | | g. Contact deposits. |
| | | h. Chambers, or pockets. |

In the general part, which follows, these different forms are discussed in the light of the latest investigations.

The forming of the siliceous gangue in fissures by lateral secretions is illustrated in the

chalk where the infusorial silica occasionally segregates into cracks instead of into flint nodules.

The breaking-down of the material of the walls of vein-fissures, its alteration, and incorporation, in place, into the gangue, are briefly but well described, and illustrated by drawings made from thin sections under the microscope. Much weight is given to the results of Sandberger's researches, which seem to establish quite firmly lateral secretion as the generally most important method of vein formation and enrichment. Mr. Phillips gives in this connection a very instructive *résumé* of some of Sandberger's results, which show the widespread distribution of both the heavy metals and the elements of the gangue substances in the constituent minerals of the common rocks.

Not less interesting are the instances cited to show the sufficiency of causes acting now and in recent times at the surface of the earth, to cause the concentration and fixation of minerals to form ore-bodies.

Thus the fact shown by Sandberger, that all lithia micas contain tin, taken in connection with the finding, in various Cornish stream-works, of deer's antlers completely replaced by crystallized oxide of tin, points at once to the existence of sufficient sources of tin in surface rocks, and to the possibility of derivation from those sources, and concentration in veins and stock-works, under conditions now prevailing at the surface. So, also, in the instances of metallic gold which have been found deposited on the woodwork of Australian mines, we have similar evidence of metallic deposition now in progress.

While Mr. Phillips considers that the evidence is largely in favor of assigning to lateral secretion the generally most important part in forming fissure-veins, he recognizes the probable action of ascension, and also of sublimation, in many individual cases. The portion of the book—about five hundred pages—devoted to the description of typical forms of deposits throughout the world is full of information desired by the economic geologist and the statistician.

The illustrative instances are well selected, and the latest available statistics of production are given, apparently, in all cases. Aside from the fact that it brings the description of the countries treated by Cotta down to the present time, the book is particularly valuable for its descriptions of practically all countries which, for various reasons, received little or no attention in Von Cotta's work.

THE MICROSCOPE IN BOTANY.

THOSE students who have been waiting for an English translation of Behrens's book on botanical methods can but be disappointed now that it has appeared. Not that the book does not contain much that is extremely valuable, nor that it is not put in an attractive form by the publishers, but that it has been made cumbersome and expensive by an inordinate amount of 'padding' not found in the German text. Figures and descriptions of American instruments are introduced with such careful discrimination, that doubtless the volume must prove eminently satisfactory to their makers, while the author's remarks on the more useful stands of continental make are entirely suppressed, possibly from a laudable wish to further home protection. The maxim of the author, that "he is the best experimenter who does his work with the simplest possible apparatus," is frequently outraged by the description of gimcracks easily dispensed with, and more properly advertised in an instrument-maker's catalogue than in the pages of an expensive handbook.

Yet, notwithstanding the fact that a two-dollar-and-a-half book has been evolved into a five-dollar book by a process the reverse of natural selection, the translation must prove a boon to the few investigators who have not sufficient command of German to use the original; and it is unquestionably more convenient for college students, who, as a rule, dread manuals in any language but their own. Those who use the book in either form will probably agree with the author that the chapters on reagents and their application in microchemical work constitute its most valuable feature, rendering it, indeed, indispensable in the laboratory where careful work is carried on. A chapter on the preparation of specimens for examination and preservation is also extremely useful, and especially the portion treating of the preparation of fossils and other hard objects.

Though a few more or less deserved slurs on English microscopists, and the author's all but complete forgetfulness that Americans ever look through the instrument, may touch the pride or appeal to the belligerence of an Anglo-American, the book is, in the main, written well and in good taste, and shows a working familiarity both with the subjects handled and the literature pertaining to them.

A guide to the microscopical investigation of vegetable substances. From the German of Dr. JULIUS WILHELM BEHRENS. Translated and edited by Rev. A. B. HERVEY, A.M., assisted by R. H. WARD, M.D., F.R.M.S. Boston, Cassino, 1885.

SOME STATE AGRICULTURAL EXPERIMENT-STATIONS.

A COMPARISON of the successive reports of the New-Jersey experiment-station shows that it has rapidly passed beyond that initial stage of nearly every American station, in which its chief duty is the 'control' of the trade in commercial fertilizers. It is still a fertilizer control station, and, as its report shows, has been active in this field; some two hundred analyses being reported, and much thought having evidently been bestowed upon the various problems arising in connection with the equitable sampling and valuation of these goods.

At the same time, this work occupies but fifty-four pages out of a total of a hundred and seventy-six, the larger portion of the remainder being taken up with reports of experiments bearing upon the broader questions of agricultural practice.

These latter furnish an admirable illustration of the class of experiments which, in a previous number of *Science*, we ventured to designate as empirical, as distinguished from rational—using these words, of course, in their technical sense. They are what are often called practical, as opposed to scientific experiments; but the word 'practical' has been so wrested, in popular use, from its proper meaning of 'pertaining to practice,' that its use in this connection is to be avoided.

Besides various minor matters, the most noteworthy experiments of this sort are the field experiments upon the growth of sorghum, and the comparison between field-corn and ensilaged fodder-corn.

In the last-named investigation, the questions proposed were, the comparative yield of digestible food per acre, the comparative cost of gathering it and preparing it for use, its relative feeding-value, and the relative exhaustion of the soil in the two cases. The results were throughout decidedly in favor of the field-corn; the grain and stalks yielding more and cheaper food per acre than the ensilaged fodder-corn, and food of equal milk-producing value, pound for pound.

The report of the Ohio station, while dealing with different subjects, resembles that of the New-Jersey station in the general character of the experiments reported. A great deal of attention has been given to testing varieties of wheat and corn, and the tables of results

contain a vast amount of valuable information. The tests of methods of seeding or planting, of cultivation, mulching, use of fertilizers, etc., are extensive, and apparently carefully conducted, though we regret to observe the somewhat common lack of an adequate discussion of the results reached. Other interesting matter is to be found in the sections devoted to small-fruits and vegetables, insects, weeds, grasses, and various other subjects.

In brief, both these stations have done most excellent work of the kind attempted; and that this kind of work meets with popular approval, is evident in New Jersey, at least, from the fact that the station's original appropriation of five thousand dollars per year has been successively raised to eight thousand and eleven thousand dollars. Under the circumstances, it is not to be wondered at that the station has turned its attention chiefly or entirely to experiments relating to the practice of agriculture. At the same time, we cannot but regret that the American stations, as a rule, many of them with reasonably ample incomes, are doing so little, comparatively, to advance the science of agriculture, believing, as we do, that 'a sound theory is the surest guide to a successful practice.'

NOTES AND NEWS.

A STATUE of Darwin, by Mr. Boehm, R.A., has just been placed in the great hall of the British museum on Cromwell Row, and arrangements for its unveiling will be made shortly. It is the gift to the nation of the Darwin memorial fund. It is found, that, after the payment of all expenses, over two thousand pounds will remain, which will form a Darwin fund, to be transferred to the Royal society, the income of which is to be appropriated in such a way as may be "best calculated to promote biological study and research."

—The Society for the prevention of cruelty to animals in the Netherlands has petitioned the government to introduce into Holland the rules with regard to vivisection drawn up by the Prussian authorities.

—In the Spanish congress on May 18, according to *Nature*, Señor Castelar called attention to Dr. Ferran's experiments in inoculation against cholera, and asked the minister of the interior to give a subvention to enable Dr. Ferran to continue his experiments on a larger scale. The minister, in reply, said he was unable to do so at present, but, as soon as it lay in his power, he would grant a sufficient sum, although, in his opinion, Dr. Ferran's experiments had not yet reached a sufficient degree of certainty to prove a complete success. He added, that a commission of medical men would be appointed to visit Valencia

Fifth annual report of the New-Jersey state agricultural experiment-station for the year 1884. Princeton, N.J., Robinson pr. 1884. 176 p. 8°.

Third annual report of the Ohio agricultural experiment-station for 1884. Printed by order of the state legislature. Columbus, Myers brothers, state printers, 1885. 240 p. 8°.

and other towns, in order to study the experiments that are being made. In reference to this subject, Dr. Cameron, M.P., writes to the *Standard* that the under-secretary for foreign affairs has promised to instruct the British minister at Madrid to send home translations of any reports bearing on the system of inoculation with cholera virus attenuated by artificial cultivation, as a protection against Asiatic cholera, discovered by Dr. Ferran of Valencia. This having come to the notice of Dr. Ferran, that gentleman has sent Dr. Cameron a telegram giving the results up to date of a great test experiment which is at present being conducted by him, under the eyes of scientific commissioners at Alcira, a town near Valencia, where an epidemic of cholera is raging. According to Dr. Ferran's telegram, the population of Alcira is 16,000, and since the first of the present month 5,432 of its inhabitants have been inoculated with his protective virus. That would leave the number of those not inoculated about 10,500, or, accepting 16,000 as an exact figure, precisely 10,568. Of the 10,500 persons who are not inoculated, cholera has attacked 64, and proved fatal to 30. Of the 5,432 who have been inoculated, it has, according to Dr. Ferran, attacked only 7, and proved fatal in no single case. In other words, since the commencement of the experiment on May 1, one person out of every 163 has been attacked among the uninoculated population, and one person in every 352 has died of cholera; while among the inoculated population only one person in 776 has been attacked, and not a single person in the entire 5,432 has died of the disease. Dr. Ferran concludes his telegram by expressing the desire that a British commission should be sent to Alcira to verify these results.

—The first edition of John's little book upon the cholera bacillus ("Ueber die Koch'schen reinculturen und die cholera bacillen," Leipzig, *Vogel*) was published in January, and a second is already out. It is a pamphlet of some twenty-eight pages, giving the most complete directions for cultivating and observing the so-called comma bacillus according to Koch's method, from the preparation of the 'meat extract gelatine' to the microscopic examination. A woodcut showing the different rapidities of liquefaction of the gelatine culture-medium by the comma bacillus of cholera, and the curved bacillus of Finkler and Prior, is given, and adds to the value of the work. It is an important contribution to the literature of bacteriology, furnishing, as it does, our first concise and complete statement of the methods of investigation of the special organism of which it treats.

—Capt. Sawyer of the bark *Vidette* reports that on May 17, 1885, a water-spout appeared to form, and rise to the north-east in a long, spiral column; position at the time, latitude 32° 10' north, longitude 78° 5' west. It rose until the sky above, extending over an area of a mile, was an inky black mass of heavy clouds, gradually moving in a south-west direction until within half a mile of the vessel, when it seemed to burst, the rain coming down in torrents for two hours. This was accompanied by sudden strong

gusts of wind, shifting suddenly from one quarter to directly the opposite one, and with a force of six to eight. To the south and south-west before and during the formation of the water-spout, the sky, to an altitude of about sixty degrees, was black and very threatening, with thunder and lightning. This continued during the time alluded to, and finally ended with several sharp claps of thunder and a fifteen-minutes' fall of hailstones. The peculiarity of these disturbances was that the wind would change very suddenly with considerable force, throwing all aback without any warning. The temperature of the water was 81°, and of the air 60° to 78°.

—The time-ball of the U. S. naval observatory is to be transferred from the dome of the observatory to a flagstaff on the new State, war, and navy department at Washington. In its new position it will be more easily seen from the city. It will be dropped, as at present, by the observatory clock, on 75th meridian time.

—Among recent deaths we note the following: Dr. A. Enneper, professor of mathematics in the University of Göttingen, at Hannover, March 24, in his fifty-fifth year; Eugène Rolland, professor of mechanics, at Paris, March 31; J. C. Döll, botanist, at Karlsruhe, March 10, in his seventy-eighth year; Gustave A. von Klöden, geographer, at Berlin, March 11, in his seventy-first year; Dr. Wilhelm Duncker, geologist, at Marburg, March 13, in his seventy-seventh year; Dr. J. Roeper, botanist, at Rostock, March 17, in his eighty-fifth year.

—Capt. George E. Belknap, U.S.N., has been ordered by the secretary of the navy to assume charge of the naval observatory on June 1, relieving Commander A. D. Brown, who has been acting superintendent since April 1, when Admiral Franklin was ordered to the command of the European squadron.

—The Harvard university bulletin for May contains nine pages more of Mr. Winsor's collation of the Kohl collection of early maps, which in this case deals with the east coast of North America, and four pages of Mr. Bliss's index to the maps in the English geographical publications, comprising a part of those of Asia.

—The third session of the International geological congress will be held this year at Berlin, commencing on the 28th of September. The meetings will occupy one week, and will be followed by geological excursions from the 5th to the 10th of October. The congress will be accompanied by an exhibition of geological charts and other collections illustrating the different branches of mineralogy and geological science. It will be remembered that this meeting was to have taken place last year, but was prevented by the outbreak of cholera.

—A memorial tablet to Professor Louis Agassiz has just been erected in the Sage Chapel of Cornell university, and will be unveiled at the approaching commencement.

—A National textile microscopical association was formed last Saturday by members of the corresponding societies of Boston and New York.